NOTES ON THE APPLICATION OF UPPER-AIR OBSERVATIONS TO WEATHER FORECASTING.

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The winds above Mount Weather during June, 1912, were not conducive to successful kite flying; on 8 days there was not sufficient wind to get them into the air, and on 7 days by reason of untoward weather conditions only low flights were obtained. On the remaining 15 days, however, altitudes of a mile or more above the mountain were attained; of these, however, but 8 flights were obtained on consecutive days and that number only, therefore, affords material for a comparison of the changes in the free air from day to day as regards temperature, wind, and humidity.

Such a comparison brings out the rather anomalous fact that the temperature may fall from one day to the next in one portion of the flight and rise in another. A well-marked case occurred in the 24 hours from the morning of the 2d until the morning of the 3d. In the lower portion of the flight—that is, from the surface up to 1,750 meters above sea level—the temperature fell, the greatest amount of fall being 7.9° C. at 1,000 meters; in the upper portion of the flight—that is, from 1,750 to 3,250 meters above sea level—the temperature rose, the greatest rise, 5.5° C., occurring at the top of the flight. No reason for this anomalous change is apparent from surface conditions nor can it be attributed to changes in the wind direction.

On the 6th, 7th, 8th, and 9th consecutive flights were made to an altitude of 3,000 meters above sea level. At the beginning of this period, June 6, Mount Weather was in a trough of low pressure and relatively high temperature aloft, as shown by the isotherm of freezing temperature being at an altitude of 3,250 meters above sea level. An extensive area of high pressure which on the morning of the 7th covered the upper Mississippi Valley was evidently the cause of a fall in temperature at all levels above Mount Weather up to 3,750 meters on that date. The greatest fall, however, was not at the surface, but at the 1,250-meter level, and this fact is in accord with the results communicated by the author in the Mount Weather Bulletin, volume 5, part 1. The above-mentioned area of high pressure continued to advance toward Mount Weather, and a further fall in temperature was noted on the 8th; the greatest fall on that date, however, occurred at the 3,000-meter level, the isotherm of freezing temperature having sunk to within 1,500 meters of sea level or 974 meters of the mountain top, which was the lowest level it reached during the month. On the following day while the crest of the area of high pressure here considered was still several hundred miles from Mount Weather and to the northwestward of that station, a change to higher temperatures from the surface up to the 3,000-meter level took place, the greatest warming, 6.9° C., occurring between the 750 and 1,500 meter levels and the change thence gradually diminished to 0.1° C. at 3,000 meters. Evidently we have here to do with a phenomenon in the atmosphere that is as yet little known or understood. On the days immediately following the 9th the area of high pressure before mentioned advanced over Mount Weather but by reason of lack of wind a flight could not be made until the 12th, 3 days later. On that day, the 12th, the isotherm of freezing temperature had risen to the 3,250-meter level and the air column was considerably warmer than on the 9th. Warming in the western portion of an area of high pressure has been observed frequently in the kite flights and commented on in Mount Weather Bulletin, volume 4, pages 320–332. On the date in question the warming was more in the central and eastern portion of the high than in the western, as is generally the case. The fact that there is a rise in temperature in the rear of an area of high pressure and a fall in its front is nothing new in meteorology in this country; the kite flights have merely shown that these phenomona extend some distance above the surface.

The changes in relative humidity from one day until the next are quite irregular, but in a general way follow the course of the humidity at the surface, an increase accompanying an area of low pressure and a decrease an area of high pressure. The winds aloft seem to change with about the same frequency as on the surface. Their significance is probably of a higher order than the surface winds since the element of local configuration of the land does not enter into consideration.